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The third section of the monograph contains a discussion of this symplastic or amorphous state, in which it is claimed that all bacteria may live and from which new cells may form. The monograph concludes with brief discussions of "conjunction" and of methods of study. While LÖHNIS' discussion of pleomorphism is excellent, it must be admitted that the sections dealing with reproductive organs and with symplasm are not entirely convincing. It is at times difficult to follow his interpretations of the illustrations. At the same time, the monograph is very suggestive of lines of work which ought to be followed in the study of the life cycles of the lower organisms. Such investigations would be well worth while.—J. F. NORTON.

Mycorhiza of forest trees.—The conclusions of McDougall²¹ that "the tree is not benefited by association with the fungus, and that the ectotrophic mycorhizas are not symbiotic associations, but are instances of the parasitism of fungi on the roots of trees," have caused some doubt of the importance ascribed to root fungi by Frank and other earlier workers. A recent preliminary paper by Melin,²² however, indicates that in all probability McDougall was unwarranted in rendering so general a verdict, and while mycorhizas may be quite unimportant for many American trees, they nevertheless assist in the nutritive processes of certain species, and may be an absolute necessity for some, as recently shown by Rayner²³ in the case of *Calluna vulgaris*.

In the present investigation Melin has found that the mycorhizas of *Pinus silvestris* and *Picea Abies* cause a limited development of rootlets. In the former the dichotomous branching is often modified by the development of nodules as large as peas, composed of many densely crowded short branches. Three mycorrhizal fungi have been isolated from the *Pinus* by this worker, and one from the *Picea*. They have been preliminarily called *Mycelium radialis silvestris* and *M. radialis abietis*. Their systematic position and internal relations are for the present left open. They are aerobic organisms growing more vigorously in an acid substratum, are exceedingly specialized, and develop slowly. No fixation of nitrogen takes place in pure cultures of the fungi, although there is evidence that the mycorhizas of *Pinus silvestris* fix the nitrogen of the air. Seeds of both these trees germinate without the fungi, and there is no dissemination of the fungi by the seed. The fungi from pure cultures infect sterile seedlings through root hairs, and the young plants then develop more vigorously. At first the hyphae grow principally in the interior of cortical cells, where they form a pseudoparenchyma of the same appearance as in the fungus mantle of the completely developed mycorrhiza. Later the "Hartig tissue" and the fungus mantle are formed.—GEO. D. FULLER.

²¹ McDougall, W. B., On the mycorhizas of forest trees. Amer. Jour. Bot. 1:51-74. pls. 4. fig. 1. 1914.

²² Melin, Elias, On the mycorhizas of *Pinus silvestris* L. and *Picea Abies* Karst. A preliminary note. Jour. Ecol. 9:254-257. 1922.

²³ Rayner, M. C., Obligate symbiosis in *Calluna vulgaris*. Ann. Botany 29:97-153. 1915.